

OFFICE OF RESEARCH AND REPORTS

Control Unit

Internal Security

~~SECRET~~  
~~CIA INTERNAL USE ONLY~~

Series Number CIA/RR EP 62-12  
Date of Document March 1962

Copy No.

Recipient

Number of Copies 75 86

1	AD/RR		
2	DDI		30 Mar 62
3	VMR, A-18		"
4	St/I/R		"
* 5	St/I	25X1A	"
6	St/P -	[REDACTED]	"
7	St/PR		"
8	St/CS		"
9 - 11	Ch/G		"
12	St/FM		"
13	EIC/S		"
14, 15	D/A		"
16, 17	D/I		"
18, 19	D/M		"
20, 21	D/S		"
22	Ch/E		"
23	AD/OO		"
24	AD/BI		"
25	AD/SI		"
26	AD/NE	25X1C	"
27, 28	S/CU		"
29 - 38	RID/AN, 2051 L Bldg.		"
39	[REDACTED]		"
40	[REDACTED]	25X1A	"
41	[REDACTED]		"
42 - 44	M/FP	DD/P	"
45 - 7386	Filed in St/P/C		"
46 - 49	LS/C P		"
50 - 58	[REDACTED] (NSA)		"
62-71	[REDACTED] State		2 Apr 62
1	[REDACTED] O C R		"
14	[REDACTED] Returned from D/A		3 Apr 62
59-60	[REDACTED] St/I/C		3 Apr 62
9	[REDACTED] Returned to St/P/C		10 Apr 62
14	ST/P/A		9 Apr 62
* 5	00/C 809		
74+75	[REDACTED] 007C		8 May 62
14	[REDACTED] 007C		14 May 62
45	[REDACTED] 00/C		21 May 62

Approved For Release 2000/04/18 : CIA-RDP79T01049A002400070001-7

25X1A 9 [REDACTED] OCT 6 June 62  
Approved 7 [REDACTED] CIA-RDP79T01049A002400070001-7  
NPIC/REF picked 6 June 62  
by courier) 8 June 62  
20 Returned from D/S  
25X1A 61 [REDACTED] on TSD/CB (CIA LIBRARY) 13 June 62  
72 [REDACTED] Ly for Army 3 July 62  
25X1A 13. [REDACTED] for Navy 5 July 62  
73 ACSE - ARMY - CIA LIBRARY 9 July 62  
25X1A 12 [REDACTED] WEIR 13 July 62 10 June 63  
76 CIA by AFCEIN-3D2 7 Aug. 62  
20 Army War College via DD/CB 10 Sept 62  
77 Mike ADIRK 28 Sept 62  
25X1A 78 CIA Library for Army Map Service 26 Oct 62  
79 CIA Library for AFCEIN 30 Oct 62  
80 [REDACTED] IR/WE 1653 8 Nov 62  
25X1C 81-82 [REDACTED] via ST/IR 40001 28 Dec 62  
83 [REDACTED] WICK for CIA 4 Jan 63  
25X1A 85 [REDACTED] ST/IR 12 Jan 63 25X1A  
84 [REDACTED] ST/IR 6 Mar 63  
12 CIA Sp. for FSIC Tech. Note Army 5 Aug 63  
81 Rec'd in ST/IR 18 Feb 64  
25X1A 16 [REDACTED] 17 Apr 64  
86 RC 22 Oct 64  
86 From RC to [REDACTED] 17 May 65

25X1A

~~SECRET~~

*ex/ice*  
31

*New*

THE ELECTRIC POWER INDUSTRY OF CUBA

CIA/RR EP 62-12

March 1962

WARNING

This material contains information affecting the National Defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law.

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

~~SECRET~~

S-E-C-R-E-T

FOREWORD

This publication presents a brief survey of the electric power industry of Cuba in the period 1956-61. It is designed to bring up to date information published before the expropriation of the foreign-owned electric power properties in mid-1960 and to consolidate intelligence collected since then. Attention is invited to National Intelligence Study (NIS) 78, Cuba, Section 62, Fuels and Power, May 1958, which summarized the situation of the industry as of the end of 1957 and which may be used in conjunction with this publication. Sources used in this publication are available in the files of this Office.

S-E-C-R-E-T

S-E-C-R-E-T

CONTENTS

	<u>Page</u>
Summary and Conclusions . . . . .	1
I. Organization . . . . .	3
II. Capacity and Production . . . . .	3
III. Sources of Energy . . . . .	9
IV. Transmission and Distribution . . . . .	10
V. Consumption . . . . .	12
VI. Vulnerabilities . . . . .	14

Appendixes

Appendix A. Estimated Capacity of Cuban Electric Powerplants with Capacities of 1,000 Kilowatts or More, as of the End of 1961 . . . . .	17
Appendix B. Capacity of Power Transformers Installed at Main Substations in Cuba, as of the End of 1960 . . .	21

Tables

1. Estimated Capacity of Powerplants in Cuba, by Administra- tive Subordination, 1956-61 and 1965 Plan . . . . .	4
2. Regional Distribution of Powerplant Capacity in Cuba, 1961 . . . . .	5
3. Gross Production of Electric Power in Cuba, 1956-61 . . .	8
4. Transmission Lines in the Centralized Power System in Cuba, as of the End of 1959 . . . . .	11
5. Estimated Consumption of Electric Power in Cuba, 1958 . .	13

Map

Cuba: Principal Powerplants, Substations, and High Tension  
Lines, 1961 inside back cover

- v -

S-E-C-R-E-T

S-E-C-R-E-T

THE ELECTRIC POWER INDUSTRY OF CUBA\*

Summary and Conclusions

The state-owned electric power industry of Cuba consists of a centralized part, organized as a consolidated enterprise for electric power under the Ministry of Industry, and a decentralized part subordinated to various other organizations.

The total generating capacity of powerplants in Cuba is estimated to have been about 950 megawatts (mw) at the end of 1961, of which 59 percent was in the centralized part. Almost one-half of the national capacity is located in or around Havana. In the next 5 years the Cubans plan to install 600 mw of new generating capacity, for which the Soviet Bloc will furnish practically all of the equipment. The gross production of electric power in Cuba is estimated to have grown from 1,960 million kilowatt-hours (kwh) in 1956 to 2,910 million kwh in 1960 and then to have declined by 19 percent to 2,360 million kwh in 1961.

Operation of the electric power industry of Cuba is almost wholly dependent on imports of fuel oil from the USSR. There are no significant reserves of fossil fuels or of hydroelectric resources in Cuba. Powerplants of the sugar industry, which generate about one-sixth of the total national production of electric power, rely largely on bagasse (sugar cane residue) as a source of energy.

In 1958, the latest year for which information on sales by classes of consumers is available, consumption of electric power in Cuba is estimated to have been as follows:

<u>Consuming Sector</u>	<u>Million Kilowatt-Hours</u>	<u>Percent</u>
Industrial		
Sugar industry	380	18
Other industry	510	24
Commercial	500	24
Residential	560	26
Governmental and other	160	8
Total end use	<u>2,110</u>	<u>100</u>
Station use and line loss	<u>340</u>	
Total gross consumption	<u>2,450</u>	

\* The estimates and conclusions in this publication represent the best judgment of this Office as of 1 February 1962.

S-E-C-R-E-T

S-E-C-R-E-T

The electric power industry of Cuba has proved to be especially vulnerable to increasing shortages of spare parts, of chemicals for water treatment, and of operative skill. As a result, some generating units have been forced out of service. The use of Soviet fuel oil, which is high in sulphur content, has fouled boilers and lowered the generating capabilities of the operating plants. The over-all reduced generating capability of the electric power industry of Cuba has not caused a significant shortage of electric power, however, because demand has fallen more rapidly than has capability.

---

S-E-C-R-E-T

S-E-C-R-E-T

## I. Organization

The electric power industry of Cuba is state-owned and consists of a centralized and a noncentralized part. The centralized part is comprised of seven powerplants with a capacity of 30 megawatts (mw) or more, several smaller powerplants, and a transmission network that stretches 300 miles from the Havana area east to Camaguey. It includes facilities formerly owned by the CCE (Compania Cubana de Electricidad -- the Cuban Electric Company) and a few other public utility plants connected to the CCE system and serves most residential, commercial, and governmental consumers and practically all industry except the sugar industry. In 1961, about 59 percent of the total national capacity and in 1960, the last year of "normal" production, almost three-fourths of the national production was in the centralized part of the industry. The noncentralized part of the industry consists of nearly 200 small, isolated powerplants, mostly associated with sugar mills, which serve local industry and workers settlements. Power generation in this latter group generally is seasonal in nature, depending in large part on the processing of the sugar crop.

In August 1960, after a year and a half of increasing degrees of government control, the CCE was nationalized. As of the end of 1961 the power facilities formerly belonging to the CCE, along with other powerplants connected to the system that were operating as public utility plants, were organized into a consolidated enterprise for electric power that had the responsibility for operation of the centralized part of the power industry. The consolidated enterprise was subordinated to the Under Secretary for Basic Industry, who was one of four Under Secretaries in the Ministry of Industry. Powerplants in the noncentralized part of the power industry connected with scattered industrial enterprises and sugar mills were subordinated to the consolidated enterprise responsible for the parent plant. Thus the consolidated enterprise for the sugar industry, which also is under the Under Secretary for Basic Industry, controls the powerplants at sugar mills.

## II. Capacity and Production

The total national generating capacity in Cuba was close to 950 mw at the end of 1961, having increased by 43 percent from about 670 mw at the end of 1956. The Castro government plans to add 600 mw in the next 5 years.

The share of the centralized power systems in the total national capacity has been increasing at the expense of the powerplants of the sugar

- 3 -

S-E-C-R-E-T



S-E-C-R-E-T

industry and of other small plants. Whereas only 44 percent of the national capacity at the end of 1956 was to be found in the centralized power systems, the share had grown to 59 percent 5 years later. During the same period the share accounted for by the powerplants of the sugar industry decreased from 47 percent of the total national capacity to 33 percent and the share of other small plants from 9 to 8 percent. The estimated capacity of electric powerplants in Cuba in the years 1956-61 and the plan for 1965 are shown in Table 1.\*

Forty-seven percent of the generating capacity of Cuba is to be found in Havana Province. The two largest powerplants in the country are located in the city of Havana -- the old Tallapiedra powerplant with a capacity of 162 mw and the new Regla powerplant with a capacity of 148 mw. Each plant has been expanded by the installation of one 66-mw West German unit since 1957.

Table 1.

Estimated Capacity of Powerplants in Cuba  
by Administrative Subordination a/  
1956-61 and 1965 Plan

Source							Megawatts
	1956	1957	1958	1959	1960	1961	1965 Plan
Cuban Electric Company	295	352	429	516	516	556 <u>b/</u>	1,220
Other utilities	16	16	16	16	16	16	
Sugar industry	311 <u>c/</u>	311	311	311	311	311 <u>d/</u>	300 <u>e/</u>
Other industry	43	43	55	65	65	65	
Total	<u>665</u>	<u>722</u>	<u>811</u>	<u>908</u>	<u>908</u>	<u>948</u>	<u>1,520</u>

a. Data shown in the table are presented as derived and consequently do not agree precisely with the rounded totals shown in the text.

b. Including 40 megawatts (mw) in the Bandaleste Thermal Powerplant, installed but not yet connected to the network.

c. Reported for 1958 and assumed to be the same in other years, for there is no indication of a change except as indicated below.

d. About 28 mw may have been retired during 1958-61 (see Table 2, p. 5, below), but no specific information is available.

e. Assuming the retirement of the older powerplants at the sugar mills.

\* All powerplants in Cuba with a capacity of 1 mw or more, along with their location and their estimated capacity as of 31 December 1961, are listed in Appendix A, p. 17, below. These plants, along with transmission lines and major substations, are located on the map, inside back cover.

S-E-C-R-E-T

S-E-C-R-E-T

The 40-mw Bandaleste plant, just east of Havana, was built by a French company in the last few years. Although the plant is completed, it is not yet connected to the power system and is not in operation, possibly because of reported settling of the foundations. Camaguey and Oriente Provinces contain 16 and 20 percent, respectively, of the national generating capacity, mostly in isolated powerplants at the sugar mills, and the other three provinces contain the remaining 17 percent. The estimated regional distribution of powerplant capacity in Cuba, as of the end of 1961, is shown in Table 2. In addition to the capacities shown in the table, the Hanabanilla Hydroelectric Powerplant in Las Villas Province with a capacity of 28 mw is to go into operation early in 1962.

Table 2

Regional Distribution of Powerplant Capacity in Cuba a/  
1961

					Megawatts
Province	Cuban Electric Company <u>b/</u>	Other Utilities	Sugar Industry	Other Industry	Total
Pinar del Rio	0	7	12	10	29
Havana	390 <u>c/</u>	9	32	17	448
Matanzas	33	0	28	1	62
Las Villas	24	0	48	0	72
Camaguey	50	0	97	0	147
Oriente	59	0	94 <u>d/</u>	37	190
Total	<u>556</u>	<u>16</u>	<u>311</u>	<u>65</u>	<u>948 e/</u>

a. Based on a summation of the capacities of individual plants.

b. Including mobile powerplants.

c. Including 40 megawatts (mw) in the Bandaleste Thermal Powerplant, installed but not yet connected to the network.

d. Including 18 mw operated primarily as utility powerplants.

e. Che Guevara has stated that the total national capacity in April 1961 was 920 mw. The discrepancy may be a result of the dismantling since 1958 of powerplants with a total capacity of 28 mw located at sugar mills. It is not known which plants have been dismantled.

At the end of 1961, Cuba had 120 stationary electric powerplants with a reported individual capacity of 1 mw or more and a total capacity

S-E-C-R-E-T

S-E-C-R-E-T

of 896 mw.\* In addition to these plants, Cuba also had 19 General Motors mobile diesel powerplants, each with a capacity of 1 mw, distributed about the country in areas of local power shortages. The remaining capacity at the end of 1961 was in more than 70 small plants at sugar mills and in several other small powerplants.

At the time of the nationalization of the Cuban electric power industry in August 1960, the CCE was engaged in a major expansion program that was to have more than doubled the generating capacity of the system within 4 years, from 516 mw at the end of 1959 to 1,171 mw at the end of 1963. The CCE plan was to install 769 mw and to retire 114 mw of older equipment. The major additions to capacity were to have been in the Havana area, where the Regla and Tallapiedra plants each were to have installed a new 66-mw unit. The largest addition in the Havana area was to have been a new 400-mw plant. The generating capacity in other areas was to have been expanded by the installation of 33-mw units in the Matanzas, O'Bourke, and Vincente plants and 22-mw units in the Santiago plant and in new powerplants to be constructed in Boqueron and Manzanillo. The equipment for these planned additions originally was to have been furnished by West German and US manufacturers, but none of the equipment has been delivered, and it is unlikely that it will be. The Cubans reportedly have contracted with a French firm to furnish the generating equipment for the addition to the Matanzas plant, which is otherwise complete.

In his speech of April 1961 on the state of the Cuban national economy, Che Guevara reported that the Cuban government plans to build 600 mw of new generating capacity in the next 5 years, bringing capacity to 1,520 mw. Guevara stated that contracts had been signed with countries of the Soviet Bloc for the construction of a total of 825 mw of new capacity, 300 mw of which was to come from the USSR, 275 mw from Czechoslovakia, and 250 mw from other countries of the Bloc. The new capacity on order from the USSR apparently includes four 50-mw units to be installed in a new powerplant at Mariel and a 100-mw unit to be installed during the years 1967-68. The 250 mw of generating equipment to be ordered from other countries of the Bloc reportedly include a 100-mw unit from Poland to be installed in the 1967-68 period and a 45-mw hydroelectric powerplant from Hungary. Aid from Czechoslovakia in the construction of new powerplants was reported in August 1961 to have been increased to include six complete thermal powerplants with a total capacity of 330 mw to be installed in the 1963-64 period and a 33-mw hydroelectric powerplant. Whether these rather ambitious plans will be implemented or even needed will depend to a great extent on the future growth of the Cuban economy.

\* See Appendix A, p. 17, below, and the map inside back cover.

S-E-C-R-E-T

S-E-C-R-E-T

Aid from the Bloc to date has consisted of one 1-mw powerplant and several much smaller mobile powerplants. No large powerplants were under construction as of the end of 1961.

Production of electric power in Cuba is estimated to have grown from 1,960 million kilowatt-hours (kwh) in 1956 to 2,910 million kwh in 1960 and then, as a result of general industrial stagnation, to have declined by 19 percent to about 2,360 million kwh in 1961. During the 4 years from 1957 to 1960 the average annual growth in production of electric power was 10.4 percent for the country as a whole and 12.2 percent for the CCE. The 19-percent decline in production of electric power in Cuba from 1960 to 1961 is estimated to have resulted largely from reduced production in the CCE system, in which production had declined to 60 percent of the level of August 1960 by August 1961. Production in the powerplants of the sugar mills in 1961 is estimated to have grown to 15 percent above the level of 1960 in order to service the 15-percent increase in the amount of sugar cane that was cut in 1961. The estimated annual gross production of electric power in Cuba during the years 1956-61, distributed by administrative subordination of the powerplant, is shown in Table 3.\*

---

\* Table 3 follows on p. 8.

S-E-C-R-E-T

Table 3

Gross Production of Electric Power in Cuba a/  
1956-61

Million Kilowatt-Hours						
Source	1956	1957	1958	1959	1960	1961
Cuban Electric Company <u>b/</u>	1,370	1,540	1,750	1,940	2,170 <u>c/</u>	1,630 <u>d/</u>
Other utilities <u>e/</u>	110	110	110	110	110	110
Sugar industry <u>f/</u>	320	380	390	400	400	460
Other industry <u>g/</u>	160	160	200	240	230	160
Total	<u>1,960</u>	<u>2,190</u>	<u>2,450</u> <u>h/</u>	<u>2,690</u>	<u>2,910</u>	<u>2,360</u>

a. Data are rounded to the nearest 10 million kilowatt-hours (kwh).

b. Estimated to be 120 percent of sales, based on company records. Annual sales for 1956-59 are from the annual reports of the American and Foreign Power Company.

c. Sales by the Cuban Electric Company (CCE) for the first 10 months of 1960 were 11.8 percent higher than for the first 10 months of 1959. It is estimated that gross production by the CCE in 1960 also would increase by about 11.8 percent in comparison with 1959.

d. Operations are reported to have fallen to 77 percent of the level of August 1960 in March 1961 and to 60 percent in August 1961. The average monthly production in 1961, therefore, is estimated to have been 68.5 percent of the level of August 1960. Gross production in August 1960 is estimated to have been 120 percent of the sales of 165 million kwh.

e. Reported to have been 106 million kwh in 1958 and estimated to have been the same in other years, as there was no change in capacity in operation.

f. Production of electric power in powerplants at sugar mills is not a recorded figure, as most plants keep no records. The Junta Nacional de Planificacion Revolucionaria estimated production of 391 million kwh in 1958. This figure has been used as a base, and the annual production has been derived from this base and from an index of the amount of sugar cane that was ground in each year, for the power that is generated is in direct relation to the cane that is ground. Purchases of electric power from other sources and the consumption of electric power for other uses than the grinding of cane cancel each other out.

g. Based on an annual use of 4,000 hours of average annual plant capacity in operation, reduced in 1961 to about 70 percent of the previous year to reflect the slowdown in industry.

h. In comparison, other estimates of production in 1958 have been 2,300 million kwh by the Agency for International Development, 2,623 million kwh by the US Federal Power Commission, and 2,592 million kwh by the Cuban Junta Nacional de Planificacion Revolucionaria.

S-E-C-R-E-T

### III. Sources of Energy

The lack of energy resources has been a serious obstacle to the development of the electric power industry of Cuba. There are no significant reserves of fossil fuels or hydroelectric resources. Production and importation of coal for the generation of electric power are negligible, and oil, the major source of fuel, is almost entirely imported.

The centralized power system relies almost wholly on residual fuel oil as a source of energy, supplemented to a small degree by diesel fuel. In 1958 the centralized power system is reported to have used 4.2 million barrels of residual fuel oil, about 36 percent of the residual fuel oil consumed in Cuba. In addition, the powerplants of the sugar mills are estimated to have used 1.4 million barrels of residual fuel oil. Since the nationalization of the industry the power industry has had to rely on imports of Soviet oil.

A number of sugar mills are equipped to use either oil or bagasse,\* but all depend almost entirely on bagasse for fuel during the harvest season, as this material is cheap and readily available when most needed. Its principal disadvantages are that none is available during the off season, as practical systems for storage have not been developed, and it cannot be burned in boilers of the CCE powerplants. As a result, during the off season powerplants at sugar mills depend on auxiliary diesel units; burn residual fuel oil; or purchase their electric power, when possible, from the public supply network. Powerplants at sugar mills generally are old and inefficient.

Hydroelectric potential and hydroelectric development in Cuba are insignificant. Most of the rivers are short, narrow, and shallow. These disadvantages are magnified by the extremely seasonal flow of water, which reaches flood proportions at certain times of the year and is meager in others. The rational development of the limited hydroelectric resources is retarded by the fact that the most mountainous part of Cuba is in southeastern Cuba in Oriente Province, far from the main consumption centers. The estimated potential for economic exploitation of hydroelectric energy in Cuba is about 300 million to 400 million kwh a year, only 10 million kwh of which have been utilized. A hydroelectric powerplant under construction at the Hanabanilla waterfall in Las Villas Province was to have gone into operation in 1959 but is still not in operation. When completed, this powerplant will produce about 90 million kwh. The Cubans recently also have engaged Czechoslovak consultants for the possible exploitation of the Toa River, where construction of two 15-mw hydroelectric powerplants, with a total production about equal to that of Hanabanilla, is believed to be possible. In addition, a project has been developed for the exploitation of the Yateras, Baconao, Jaibo, and

\* The residue of sugar cane after the juice has been extracted.

S-E-C-R-E-T

S-E-C-R-E-T

Guantanamo Rivers in Oriente Province, with one 40-mw and three 10-mw hydroelectric powerplants, and possible production of about 100 million to 200 million kwh.

In 1957 the Batista regime had decided to build a nuclear powerplant in Pinar del Rio and late in 1958 gave a letter of intent to a British firm, which was to design the plant and supervise the construction. In November 1959 the Castro regime agreed that it was ready to go ahead with a project for two nuclear powerplants in Pinar del Rio Province, a 60-mw plant at Pinar del Rio and a 40-mw plant at Matahambre. Although the need for nuclear power is particularly great in Cuba because of the lack of indigenous fuels, there is nothing to indicate that this project has progressed beyond the talking stage.

#### IV. Transmission and Distribution

The transmission and distribution network of the former CCE constitutes essentially the whole of the transmission and distribution system of the Cuban electric power industry. Lines from sugar mills and other industrial powerplants to adjacent areas exist, but generally they are of minor significance. Principal lines existing and under construction are shown on the map.\*

At the end of 1959 the CCE had a total of 6,618 miles of operating electric lines of all voltages. The majority of these were overhead lines strung on wooden poles. Mileages, by voltage and type, are shown in Table 4.\*\*

The centralized power system, formerly under the CCE, is made up of separate western and eastern systems, of which the western system is much more important. When the 110-kilovolt (kv) line between Tuinicu and Santa Clara, under construction since 1958, is completed, a 110-kv line will stretch 300 miles from Havana to Camaguey and will form the backbone of the western system. The line will connect the principal load centers of Havana, Matanzas, Cienfuegos, Santa Clara, and Ciego de Avila. A 110-kv line also is under construction from the Hanabanilla hydroelectric powerplant to Santa Clara and probably will be in operation early in 1962. The smaller eastern system is centered on Santiago and has one 110-kv transmission line from Santiago to Guantanamo.

At the end of 1960 the total transformer capacity installed in the CCE system was 1,326 megavolt-amperes (mva), distributed in mva as follows:

\* Inside back cover.

\*\* Table 4 follows on p. 11.

S-E-C-R-E-T

S-E-C-R-E-T

	<u>Western System</u>	<u>Eastern System</u>	<u>Total</u>
Generating stations	695	85	780
Transmission substations	507	21	528
Isolated substations	13	5	18
Total	<u>1,215</u>	<u>111</u>	<u>1,326</u>

The main substations in Cuba are listed in Appendix B\* and are shown on the map.\*\*

Table 4

Transmission Lines in the Centralized Power System in Cuba  
as of the End of 1959

<u>Type</u>	<u>Miles</u>	
	<u>In Operation</u>	<u>Under Construction</u>
Overhead: Wood		
11 kv a/	39.33	0
13.2 kv	642.25	53.53
33 kv	1,189.91	34.33
66 kv	35.90	0
110 kv	300.08	102.30
Under 11 kv	4,218.23	101.76
Subtotal	<u>6,425.70</u>	<u>291.92</u>
Overhead: Steel		
33 kv	1.73	0
66 kv	2.16	0
110 kv	76.12	4.73
Subtotal	<u>80.01</u>	<u>4.73</u>
Underground		
13.2 kv	105.55	2.21
110 kv	4.88	0
Under 11 kv	1.48	0
Subtotal	<u>111.91</u>	<u>2.21</u>
Total	<u>6,617.62</u>	<u>298.86</u>

a. Kilovolt.

\* P. 21, below.

\*\* Inside back cover.

S-E-C-R-E-T



S-E-C-R-E-T

Primary distribution throughout Cuba is at 2.4, 6.6, and 13.2 kv. About 90 mw of the capacity of the Tallapiedra plant feeds directly into 13.2-kv underground circuits for distribution in Havana. Electric current is generated and distributed at 60 cycles. Secondary distribution is at 120/240 volts, the same as in the US.

#### V. Consumption

An estimated pattern of consumption of electric power in Cuba in 1958 is shown in Table 5.\* Information on the pattern of consumption of electric power from the CCE is not available for later years. The total sales of electric power by the CCE in 1958 were 1,460 million kwh, more than two-thirds of the estimated total end use of electric power in Cuba of 2,110 million kwh. Residential and commercial groups, which were the principal classes of consumers of electric power from the CCE, had been increasing their relative consumption at the most rapid rate of any classes of consumers. In 1957, for instance, residential and commercial consumption increased 12.8 and 13.8 percent, respectively, whereas industrial consumption from the CCE network grew 11.6 percent and governmental uses (predominantly street lighting, street railways, and water and sewage pumping) grew only 6.3 percent.

In 1958, residential sales by the CCE were 500 million kwh. The most important factor in the rapid growth of consumption by residential consumers had been the increased consumption per capita, which grew from 521 kwh in 1952 to 753 kwh in 1957. Almost all residences in the Havana area and more than one-half of those in other large urban areas use electricity. In the countryside, however, there are few areas in which more than 20 percent of the households use electricity. Residential consumption of electricity in areas outside the CCE area never has been reported. It is estimated that such use in 1958 was about 60 million kwh and that the total residential consumption in Cuba in 1958 was about 560 million kwh. This amount was 23 percent of the total estimated generation and 27 percent of the total estimated end use.

Commercial sales of the CCE reached 480 million kwh in 1958. A significant factor in the growth of commercial sales was the continued expansion of the use of air conditioning, refrigeration, and similar conveniences. An effect of the growing demand engendered by air conditioning was an increase in peak loads during the summer months. Commercial use outside the CCE area is negligible, and the total consumption of electricity by commercial establishments in Cuba in 1958 is estimated to be about 500 million kwh, equivalent to 20 percent of the total gross consumption and 24 percent of the total end use.

\* Table 5 follows on p. 13.

S-E-C-R-E-T

S-E-C-R-E-T

Table 5  
Estimated Consumption of Electric Power in Cuba  
1958

Consuming Sector	Million Kilowatt-Hours					
	Source			Total		
	Cuban Electric Company <u>a/</u>	Other Utilities <u>b/</u>	Sugar Industry	Other Industry	Amount	Percent of Gross End Use
Industrial						
Sugar industry	20	10	350 <u>c/</u>	0	380	16
Other industry	310	20	0	180 <u>c/</u>	510	21
Commercial	480	20	0	0	500	20
Residential	500	30	20 <u>d/</u>	10 <u>d/</u>	560	22
Governmental and other	150	10	0	0	160	7
Total end use	<u>1,460</u>	<u>90</u>	<u>370</u>	<u>190</u>	<u>2,110</u>	<u>86</u>
Station use and line loss	290 <u>e/</u>	20	20 <u>f/</u>	10 <u>f/</u>	340	14
Total gross consumption <u>e/</u>	<u>1,750</u>	<u>110</u>	<u>390</u>	<u>200</u>	<u>2,450</u>	<u>100</u>

a. Data for sales to industry, commercial establishments, residences, and governmental agencies are based on reported information. All data in this table are rounded to the nearest 10 million kilowatt-hours.

b. Other than consumption by the sugar industry, production is distributed approximately in the same proportion as consumption of the Cuban Electric Company.

c. Residual.

d. Estimated to be about 5 percent of the total gross consumption.

e. See Table 3, p. 8, above.

f. Estimated to be 5 percent of the total gross generation, which in this case is equal to the gross consumption from the source indicated.

S-E-C-R-E-T

S-E-C-R-E-T

The 330 million kwh sold by the CCE to industry in 1958 were equal to 37 percent of the total estimated consumption of 890 million kwh by industry. Most of the CCE industrial sales were in the Havana area, whereas outside this area local industrial powerplants furnished the electric power.

The major industrial consumer of electric power in Cuba is the sugar industry, which is estimated to have used 380 million kwh in 1958 for industrial purposes -- equivalent to 43 percent of the total consumption by industry. Most production of electric power by powerplants at the sugar mills is consumed by the mills themselves, with a small amount being used by the surrounding settlement or sold to other local consumers. Consumption of electric power by the sugar industry is highly seasonal. During the grinding season of 3 to 6 months, generating facilities generally are used to nearly full capacity, whereas in the off season the powerplants at the sugar mills often are shut down. In 1958, production of electricity in powerplants at the sugar mills was 370 million kwh in the grinding season but only 20 million kwh in the off season. In the off season the sugar mills also purchased 30 million kwh from public utility powerplants to meet residual requirements.

Consumption of electric power by the government is predominantly for street lighting, street railways, and water and sewage pumping. Governmental consumption for military and communications installations is furnished almost wholly by small local and mobile power stations, for which no aggregative information is available.

The facilities of the CCE generally have been adequate to handle peak loads. The annual peak load of the company grew from 194 mw in 1952 to 340 mw in 1960. Peak loads have fallen off in 1961, being in the range of 220 to 315 mw compared with a peak load of about 370 mw, which would have been expected if conditions had been normal. The additional growth in the capacity of powerplants has resulted in a current situation in which reserves are higher than they have been for some time in spite of larger numbers of units being out of service or in operation at lower capacities.

#### VI. Vulnerabilities

The electric power industry of Cuba has proved to be quite vulnerable to the interdiction of the supply of US equipment, fuels, and materials. In addition, the shortage of experienced personnel, resulting from the departure of many engineers and workers, has led to confusion in planning and inadequate maintenance. The Soviet Bloc has sent some electric power technicians to Cuba, but apparently they have not proved to be very effective in solving immediate problems.

S-E-C-R-E-T

S-E-C-R-E-T

A serious shortage of spare parts is developing as parts wear out or are sabotaged and no replacements are available from the US. About 90 percent of the equipment of the CCE, and probably of the electric power facilities of Cuba as a whole, are of US origin. The percentage is lower for turbogenerators, which in a great number of instances were ordered from Europe, but higher for boilers, transformers, and auxiliaries. By the end of 1961 the CCE was reported to have used up its stocks of spare parts for new construction or maintenance. Because of the limited number of types, electrical equipment can be cannibalized fairly readily from less frequently used installations for use in installations of higher priority. It has been reported that the 110-kv line from Santiago to Guantanamo will be dismantled and that the parts will be used elsewhere, possibly to finish the line from Tuinicu to Santa Clara.

The Cubans have tried to obtain the needed US equipment through Canadian or Mexican channels but with negligible success. They also have sought to obtain 60-cycle equipment from Czechoslovak and East German manufacturers but have met with no great success so far, as these suppliers are organized to build 50-cycle equipment and most equipment for export to Cuba would have to be made on special order.

The powerplants of the CCE are very vulnerable because of their absolute need for water treatment chemicals. Cuba manufactures sulphuric acid, sodium chloride, and sodium hypochlorite, but the balance of water treatment chemicals must be imported from elsewhere. Particularly needed are disodium and trisodium phosphate, sodium hydroxide, and soda ash. The most critical need, however, is for resins, both basic and acid, as it is not possible to demineralize water without them. Demineralized water is particularly needed in high-pressure boilers at the large plants where the ion exchange method of demineralization is used.

The CCE has had to change its burners to use the Soviet oil being supplied, which is lower in viscosity than the heavy oil that formerly had been used. The Soviet fuel oil, which does not burn so cleanly as the US product, largely because of the sulphur and vanadium content, has reduced the capability of the boilers. Improper maintenance and a lack of spare parts have led to the shutting down of some generating units, and reduced boiler capability has forced the remaining units to operate at lower levels. The resulting lower generating capability has not as yet done any harm to the Cuban economy, because although capability has dropped by 10 to 15 percent, the demand has fallen by twice that amount.

S-E-C-R-E-T

## APPENDIX A

ESTIMATED CAPACITY OF CUBAN ELECTRIC POWERPLANTS  
WITH CAPACITIES OF 1,000 KILOWATTS OR MORE  
AS OF THE END OF 1961

Number on Map a/*	Name	Province	Location	Capacity (kilowatts)	Type of Plant	Subordination
60	Adela	Las Villas	Adela	1,405	Steam-diesel	Sugar industry
67	Adelaida	Camaguey	Adelaida	3,700	Steam-diesel	Sugar industry
81	Agramonte	Camaguey	Florida	2,045	Steam-diesel	Sugar industry
34	Alava	Matanzas	Alava	2,000	Steam	Sugar industry
65	Algodones	Camaguey	Algodones	1,360	Steam-diesel	Sugar industry
110	Alto Cedro	Oriente	Marcane	2,325	Steam-diesel	Sugar industry
112	America	Oriente	America	3,750	Steam	Sugar industry
25	Amistad	Havana	Guines	2,440	Steam	Sugar industry
5	Andorra	Pinar del Rio	Artemisa	1,500	Steam	Sugar industry
52	Andreita	Las Villas	Cruces	2,000	Steam	Sugar industry
102	Baguanos	Oriente	Baguanos	3,070	Steam-diesel	Sugar industry
117	Baltony	Oriente	Baltony	3,700	Steam-diesel	Sugar industry
75	Baragua	Camaguey	Baragua	4,250	Steam	Sugar industry
10	Bauta	Havana	Bauta	5,000	Steam	Other industry
115	Borjita	Oriente	Borjita	1,190	Steam-diesel	Sugar industry
104	Boston	Oriente	Banes	4,750	Steam	Sugar industry
94	Cacocum	Oriente	Cacocum	1,295	Steam-diesel	Sugar industry
82	Camaguey	Camaguey	Camaguey	15,500	Steam	CCE b/ Sugar industry
54	Caracas	Las Villas	Caracas	2,350	Steam-diesel	Sugar industry
29	Cardenas	Matanzas	Cardenas	1,312	Steam	Other industry
30	Carolina	Matanzas	Carolina	1,160	Steam-diesel	Sugar industry
76	Cespedes	Camaguey	Cespedes	4,120	Steam-diesel	Sugar industry
93	Chaparra	Oriente	Chaparra	7,000	Steam	Sugar industry
72	Ciego de Avila	Camaguey	Ciego de Avila	3,700	Diesel	CCE

\* Footnotes follow on p. 20.

- 17 -

S-E-C-R-E-T

Number on Map	Name	Province	Location	Capacity (Kilowatts)	Type of Plant	Subordination
49	Cienfuegos	Las Villas	22°09' N - 80°27' W	6,000	Steam	CCE
48	Cienfuegos (O'Bourke)	Las Villas	22°09' N - 80°27' W	11,000	Steam	CCE
44	Constancia	Las Villas	22°35' N - 79°52' W	4,330	Steam	Sugar industry
43	Corazon de Jesus	Las Villas	22°44' N - 80°04' W	1,000	Steam	Sugar industry
47	Covadonga	Las Villas	22°22' N - 80°49' W	1,660	Steam-diesel	Sugar industry
36	Cuba	Matanzas	22°44' N - 81°17' W	3,400	Steam	Sugar industry
70	Cunagua	Camaguey	22°05' N - 78°24' W	9,695	Steam-diesel	Sugar industry
92	Delicias	Oriente	21°11' N - 76°34' W	8,000	Steam	Other utilities
89	Elia	Camaguey	21°01' N - 77°25' W	4,150	Steam-diesel	Sugar industry
118	Ermita	Oriente	20°11' N - 75°25' W	2,275	Steam-diesel	Sugar industry
32	Espana	Matanzas	22°49' N - 81°01' W	5,250	Steam	Sugar industry
119	Esperanza	Oriente	20°08' N - 75°12' W	1,450	Steam-diesel	Sugar industry
99	Estrada Palma	Oriente	20°16' N - 76°58' W	3,150	Steam-diesel	Sugar industry
79	Estrella	Camaguey	21°36' N - 78°18' W	1,620	Steam-diesel	Sugar industry
6	Fajardo	Havana	22°49' N - 82°28' W	1,435	Steam-diesel	Sugar industry
106	Fidencia	Oriente	20°46' N - 75°36' W	1,500	Steam	Other industry
56	Florida	Las Villas	22°21' N - 79°40' W	1,335	Steam-diesel	Sugar industry
77	Florida	Camaguey	21°33' N - 78°15' W	4,230	Steam-diesel	Sugar industry
88	Francisco	Camaguey	20°49' N - 77°35' W	6,600	Steam-diesel	Sugar industry
24	Gomez Mena	Havana	22°48' N - 81°55' W	5,630	Steam-diesel	Sugar industry
16	Hanabaniilla c/ Havana	Las Villas	22°07' N - 80°08' W	28,000	Hydroelectric	Other utilities
15	(Distillery) Havana	Havana	20°09' N - 82°22' W	6,500	Steam	Other industry
17	(Bandaeste) Havana	Havana	20°09' N - 82°22' W	40,000	Steam	Other utilities
14	(Paper Mill) Havana (Regia)	Havana	20°09' N - 82°22' W	5,500	Steam	Other industry
12	Havana (Rincon de Melones)	Havana	20°09' N - 82°22' W	148,000	Steam	CCE
13	Havana (Rincon de Melones)	Havana	20°09' N - 82°22' W	20,000	Diesel	CCE
11	Havana (Tallapiedra)	Havana	20°09' N - 82°22' W	16,000	Steam	CCE
20	Hershey	Havana	20°09' N - 82°22' W	162,000	Steam	CCE
19	Hershey	Havana	23°08' N - 81°57' W	6,500	Steam	Sugar industry
	Hershey	Havana	23°08' N - 81°57' W	9,000	Steam	Other utilities

- 18 -

S-E-C-R-E-T

## S-E-C-R-E-T

Number on Map a/	Name	Province	Location	Capacity (kilowatts)	Type of Plant	Subordination
50	Hormiguero	Las Villas	Hormiguero	2,660	Steam-diesel	Sugar industry
95	Isabel "B"	Oriente	Media Luna	1,000	Steam-diesel	Sugar industry
78	Jarom	Camaguey	Jarom	13,115	Steam-diesel	Sugar industry
64	Jatibonico	Camaguey	Jatibonico	2,320	Steam-diesel	Sugar industry
90	Jobabo	Oriente	Jobabo	2,300	Steam-diesel	Sugar industry
3	La Francia	Pinar del Rio	La Francia	1,975	Steam-diesel	Sugar industry
84	Lugareno	Camaguey	Lugareno	3,325	Steam-diesel	Sugar industry
100	Mabay	Oriente	Julia	1,000	Steam	Sugar industry
87	Macareno	Camaguey	Manopla	2,735	Steam-diesel	Sugar industry
91	Manati	Oriente	Manati	5,675	Steam-diesel	Sugar industry
46	Manuelita	Las Villas	Manuelita	1,000	Steam	Sugar industry
8	Maribel	Pinar del Rio	Maribel	5,500	Steam	Other industry
97	Manzanillo	Oriente	Manzanillo	3,000	Diesel	CCE
1	Matanzas	Pinar del Rio	Matanzas	4,000	Steam	Other industry
28	Mercedes	Matanzas	Matanzas	33,000	Steam	CCE
38	Mercedita	Havana	Mercedes	2,350	Steam-diesel	Sugar industry
22	Miranda	Oriente	Melena del Sur	3,560	Steam-diesel	Sugar industry
111	Pedro Soto Alba	Oriente	Miranda	5,345	Steam-diesel	Sugar industry
120	Moron	Camaguey	Moa	10,000	Steam	Other industry
68	Narcisa	Las Villas	Pina	6,000	Steam	Sugar industry
62	Nela	Las Villas	Yaguajay	2,225	Steam-diesel	Sugar industry
63	Nicar	Oriente	Nela	1,230	Steam-diesel	Sugar industry
107	Orozco	Pinar del Rio	Nicar	25,000	Steam	Other industry
21	Occidente	Havana	Orozco	1,657	Steam-diesel	Sugar industry
113	Palma	Oriente	Occidente	1,040	Steam-diesel	Sugar industry
69	Perseverancia	Camaguey	Palma	6,110	Steam	Sugar industry
45	Pinar del Rio	Las Villas	Patria	2,000	Steam	Sugar industry
2	Porfuerza	Pinar del Rio	Perseverancia	2,800	Steam	Sugar industry
39	Preston	Matanzas	Pinar del Rio	6,900	Steam	Other utilities
105	Providencia	Havana	Porfuerza	2,000	Steam	Sugar industry
23	Punta Alegre	Camaguey	Preston	6,750	Steam	Sugar industry
66	Quipuzcoa	Matanzas	Providencia	2,900	Steam	Sugar industry
31	Rio Cauto	Oriente	Punta Alegre	4,700	Steam-diesel	Sugar industry
27	Rosario	Havana	Quipuzcoa	1,935	Steam-diesel	Sugar industry
53	San Agustin	Las Villas	Rio Cauto	3,400	Steam	Sugar industry
59	San Agustin	Las Villas	Aquecate	2,000	Steam	Sugar industry
			Cruces	2,000	Steam	Sugar industry
			San Agustin	2,000	Steam	Sugar industry

Number on Map a/	Name	Province	Location	Capacity (Kilowatts)	Type of Plant	Subordination
26	San Antonio	Havana	Madriga	2,000	Steam	Sugar industry
4	San Cristobal	Pinar del Rio	San Cristobal	4,200	Steam-diesel	Sugar industry
51	San Francisco	Las Villas	San Francisco	1,250	Steam	Sugar industry
109	San German	Oriente	San German	4,185	Steam-diesel	Sugar industry
41	San Isidro	Las Villas	Quemada del Quines	3,250	Steam	Sugar industry
9	San Ramon	Pinar del Rio	San Ramon	1,500	Steam	Sugar industry
114	Santa Ana	Oriente	Auza	1,475	Steam-diesel	Sugar industry
57	Santa Isabel	Las Villas	Fomento	1,300	Steam	Sugar industry
101	Santa Lucia	Oriente	Santa Lucia	2,475	Steam-diesel	Sugar industry
86	Santa Marta	Camaguey	Santa Marta	3,955	Steam-diesel	Sugar industry
96	Santa Regina (Ofelia)	Oriente	Santa Regina	1,600	Steam	Sugar industry
55	Santa Rosa	Las Villas	Ranchuelo	1,000	Steam	Sugar industry
116	Santiago	Oriente	Santiago	33,900	Steam	CCE
35	Santo Domingo	Matanzas	Santo Domingo	1,150	Steam	Sugar industry
83	Senado	Camaguey	Senado	3,280	Steam-diesel	Sugar industry
85	Siboney	Camaguey	Marchena	1,282	Steam-diesel	Sugar industry
74	Stewart	Camaguey	Stewart	4,000	Steam	Sugar industry
103	TacaJo	Oriente	TacaJo	2,700	Steam-diesel	Sugar industry
108	Tanamo	Oriente	Cayo Mambé	3,350	Steam-diesel	Sugar industry
33	Tinguaro	Matanzas	Tinguaro	3,500	Steam	Sugar industry
18	Toledo	Havana	Marianao	4,740	Steam-diesel	Sugar industry
58	Trinidad	Las Villas	Trinidad	1,125	Steam-diesel	Sugar industry
61	Tuinicu	Las Villas	Tuinicu	2,000	Steam	Sugar industry
42	Ulaclia	Las Villas	Rodrigo	1,500	Steam	Sugar industry
80	Viententes	Camaguey	Viententes	4,225	Steam-diesel	CCE
73	Violeta	Camaguey	Violeta	30,000	Steam-diesel	Sugar industry
71	Washington	Las Villas	Washington	4,450	Steam-diesel	Sugar industry
40	Zorrilla	Matanzas	Zorrilla	1,400	Steam	Sugar industry
37				1,417	Steam-diesel	Sugar industry

a. Inside back cover.

b. Cuban Electric Company.

c. Not in operation as of the end of 1961.



S-E-C-R-E-T

## APPENDIX B

CAPACITY OF POWER TRANSFORMERS INSTALLED AT MAIN SUBSTATIONS IN CUBA  
AS OF THE END OF 1960

Number on Map a/	Substation	Voltage Rating (Kilovolts)	Capacity (Megavolt-Amperes)
22	Boqueron	110/3.2	25.0
17	Camaguey	110/33	59.0
15	Ciego de Avila	33/4	3.0
10	Colon	110/33/7.2	8.6
19	Contramaestre	66/33	6.9
12	Cruces	66/33/4	3.7
11	Cuatro Caminos	66/33	12.5
6	Diezmero	110/33	50.0
9	Jovellanos	33/6.6	5.5
18	Manzanillo	33/6.6/2.3	3.1
8	Matanzas	110/33	70.1
4	Melones	110/33/13.2	77.3
3	Naranjito	110/66/33	96.7
5	Regla	110/33/13.2	258.8
7	Rincon	110/66/33/6.6	66.8
2	Sama	33/13.2	23.3
13	Santa Clara	110/66/33/13.2	64.5
20	Santiago	110/66/33/13.2	55.0
21	Texas Company	66/2.3	5.0
1	Tropical	110/13.2	75.0
14	Tuinicu	110/33	7.5
16	Vincente	110/33/13.2	57.0

a. Inside back cover.

- 21 -

S-E-C-R-E-T

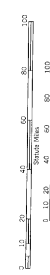
CONFIDENTIAL

CONFIDENTIAL

GULF OF MEXICO

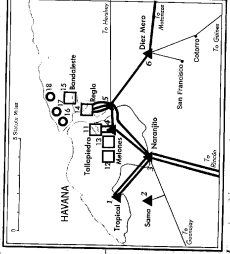
# CUBA PRINCIPAL POWERPLANTS, SUBSTATIONS AND HIGH TENSION LINES, 1961

- Public utility powerplant
- Other powerplant
- Major substation
- 110-kilovolt high tension line
- 33-kilovolt high tension line



CONFIDENTIAL

Approximate locations of powerplants and substations shown in this map are for reference only.



Approved For Release 2000/04/18 : CIA-RDP79T01049A002400070001-7

  
SECRET

  
SECRET

Approved For Release 2000/04/18 : CIA-RDP79T01049A002400070001-7